

# Managing Poultry Manure Nutrients

**A**rkansas is nicknamed the “Land of Opportunity,” and Agricultural Research Service scientists there are taking every opportunity to preserve the state’s natural beauty by helping to reduce the impact of runoff from poultry litter.

Scientists in the ARS Poultry Production and Product Safety Research Unit at Fayetteville are focusing on soil properties and slope, the seasonal dynamics of surface runoff, and the effects of adding aluminum sulfate to poultry litter to optimize manure application.

“We’re searching for ways to reduce nutrient runoff from poultry litter into lakes and streams,” says soil chemist Philip A. Moore, Jr. “The first step is determining where runoff does and does not occur, so we can find better ways to manage it.”

More than 7.5 billion broiler chickens raised in the United States each year produce up to 7 million tons of poultry litter. The litter is a mixture of chicken manure, feathers, spilled food, and bedding material. Many farmers use it as an inexpensive fertilizer for cropland because the manure contains nitrogen and phosphorus, two important fertilizer ingredients. But water that runs off fields fertilized with poultry litter may carry excess nutrients to nearby waterways, hurting water quality and aquatic life.

Soil scientist Thomas J. Sauer is looking at ways to manage litter to minimize this runoff.

“Many things can influence nutrient runoff after animal manure is applied, including weather, physical and chemical properties of the soil, and land use,” he says.

In a recent field study, Sauer found that trends in the measured soil’s chemical and physical properties were related to its slope and plant cover—for example, pasture versus

forest. If farmers take these things into consideration, they can reduce nutrient runoff. For example, silty alluvial soils found near rivers are potentially important in capturing runoff from upland pastures before it reaches the river.

## More To Be Learned

Sauer says additional research is needed to verify the role that areas along streams and rivers play in retaining nutrients delivered from uphill pastures. And, he says, farmers developing best-management practices for poultry litter application should pay close attention to areas with low water infiltration rates and to upland pasture soils’ ability to retain applied nutrients.

At a site in Arkansas, Sauer and Moore studied two small watersheds within a tall fescue pasture. They installed automated equipment to measure the rate and composition of runoff. They also installed sensors to measure precipitation and soil moisture and to continuously record evaporation.

“Some important trends are already apparent,” reports Sauer.

“Throughout the summer of 1997, evaporation dominated the water balance. The tall fescue grass showed strong drought tolerance and withdrew water from deep down, after the surface layers became very dry,” he says. “By summer’s end, it took several significant rainfalls to replenish soil moisture in the root zone before groundwater movement began.”

The researchers applied poultry litter to the watersheds in May 1997. Because of below-normal rainfall, no runoff occurred until January 1998.

“We hope to relate the occurrence, timing, and volume of surface runoff to storm characteristics, height of the grass, and surface soil moisture content,” says Sauer.

“Preliminary figures from our site in Arkansas suggest that information on soil properties and slope could be used to develop and improve strategies for applying animal waste to land. This type of approach could supplement existing methods for assessing nutrient runoff.

“Poultry litter,” Sauer says, “can be a valuable nutrient and organic matter resource that can help sustain and revitalize a grower’s soil, if soil and landscape position information are used in designing land application programs.”

Farmers may be able to reduce runoff simply by planting the right grass. Moore is interested in seeing if

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**Soil scientist Philip Moore looks for signs of dermatitis on a chicken raised in a poultry house with alum-treated litter. Alum has been shown to reduce dermatitis in chickens.**

different grasses affect runoff. LeAnn Davis, a graduate student at the University of Arkansas who works with Moore, found there was less water and phosphorus runoff with tall fescue grass compared to eastern gamagrass, switchgrass, bermudagrass, or bluestem grass.

They're not sure at this point in the study why there are differences in effectiveness among the grasses.

### **Alum Cleanses Runoff**

Treating poultry litter with aluminum sulfate (alum) also helps reduce

nutrient runoff. Moore developed and patented a method for adding alum to poultry litter. He found that it reduced phosphorus runoff. [See "A Cleanup for Poultry Litter," *Agricultural Research*, May 1994, pp. 10-11.]

Since his original findings, Moore has discovered even more benefits from using alum.

In recent field studies, he added alum to poultry litter in chicken houses at two farms in Arkansas—the largest chicken-producing state. It was applied to used litter after one group of chickens had been removed and before the next group was started. Later, he fertilized fields with

the treated litter to see how it would affect phosphorus runoff.

"Not only did the alum reduce phosphorus runoff by 70 percent, it cut runoff of heavy metals such as copper, iron, and zinc by 40 to 50 percent," Moore says.

Alum has added safety and production benefits: It reduces ammonia released from chicken manure into poultryhouse air. Moore says decreasing ammonia improves breathing conditions for the birds.

"It also reduces poultryhouse workers' health risks from inhaling ammonia," he adds. "Chronic exposure to high ammonia levels can cause respiratory problems."

Broilers grown in alum-treated poultryhouses weighed more on average than those in nontreated houses—3.8 pounds versus 3.65 pounds.

Another economically important advantage that Moore found was improved feed conversion in birds raised in alum-treated houses. Growers who participated in a recent study found less feed was needed to produce a pound of chicken in alum-treated houses.

The patented alum treatment is licensed to General Chemical in Parsippany, New Jersey, under the product name Al+Clear. Poultry growers in 15 states and Canada are using alum.

"Widespread use of this technology should reduce the negative impact of runoff from poultry waste on water quality," says Moore.—By **Tara Weaver, ARS.**

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**To understand more about the interaction between surface runoff and groundwater, ARS soil scientist Thomas Sauer (right) and Van Brahana, a hydrogeologist with the U.S. Geological Survey's Water Resources Division, use a conductivity meter to assess the flow dynamics of a natural spring.**